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**CLAIMS:**

What is claimed is:

1. A method of performing branch prediction in a computer program, comprising the steps of:
  - associating one or more hardware counters with one or more branch instructions;
  - using the one or more hardware counters, autonomically counting branch instructions that are executed to generate branch statistics;
  - predicting branches to be taken using the branch statistics.
2. The method of claim 1, wherein the one or more branch instructions are associated with one or more branch statistics, and wherein the branch statistics are stored in one or more branch statistic fields.
3. The method of claim 2, wherein the branch statistic fields store a plurality of data on an associated branch instruction, wherein a first datum of the plurality of data is accessed for branch prediction when the program is in a first mode, and wherein a second datum of the plurality of data is accessed for branch prediction when the program is in a second mode.
4. The method of claim 2, wherein the branch statistic fields include a branch count per instruction field that

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represents the number of times a branch is taken for that instruction.

5. The method of claim 1, wherein upon occurrence of a predetermined event, the computer program switches branch prediction operating modes on a conditional branch instruction.

6. The method of claim 1, wherein the branch statistics are stored in a performance instrumentation shadow cache.

7. The method of claim 1, wherein branches per instruction are counted during execution of the computer program.

8. A computer system, comprising:

one or more hardware counters associated with one or more branch instructions of a program;

one or more branch statistic fields for storing branch statistics associated with the one or more branch instructions;

wherein when a branch instruction is executed in the program, a hardware counter of the one or more hardware counters autonomically updates a branch statistic in a branch statistic field.

9. The system of claim 8, wherein the branch statistics are used to make branch predictions in the program.

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10. The system of claim 8, further comprising a plurality of operating modes of the program, wherein for a first branch instruction, an associated branch statistics field stores first branch statistics for a first mode of the plurality and second branch statistics for a second mode of the plurality.

11. The system of claim 8, wherein the branch statistic fields include a branch count per instruction field that represents the number of times a branch is taken for that instruction.

12. The system of claim 8, wherein upon occurrence of a predetermined event, the program switches branch prediction operating modes on a conditional branch instruction.

13. The system of claim 8, wherein the branch statistics are stored in a performance instrumentation shadow cache.

14. The system of claim 8, wherein branches per instruction are counted during execution of the program.

15. A computer program product in a computer readable medium, comprising:

    first instructions for associating one or more hardware counters with one or more branch instructions;  
    using the one or more hardware counters, second instructions for autonomically counting branch

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instructions that are executed to thereby generate branch statistics;

third instructions for predicting branches to be taken using the branch statistics.

16. The computer program product of claim 15, wherein the one or more branch instructions are associated with one or more branch statistics, and wherein the branch statistics are stored in the one or more branch statistic fields.

17. The computer program product of claim 16, wherein the branch statistic fields store a plurality of data on an associated branch instruction, wherein a first datum of the plurality of data is accessed for branch prediction when the program is in a first mode, and wherein a second datum of the plurality of data is accessed for branch prediction when the program is in a second mode.

18. The computer program product of claim 16, wherein the branch statistic fields include a branch count per instruction field that represents the number of times a branch is taken for that instruction.

19. The computer program product of claim 15, wherein upon occurrence of a predetermined event, the computer program switches branch prediction operating modes on a conditional branch instruction.

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20. The computer program product of claim 15, wherein the branch statistics are stored in a performance instrumentation shadow cache.

21. The computer program product of claim 15, wherein branches per instruction are counted during execution of the computer program.